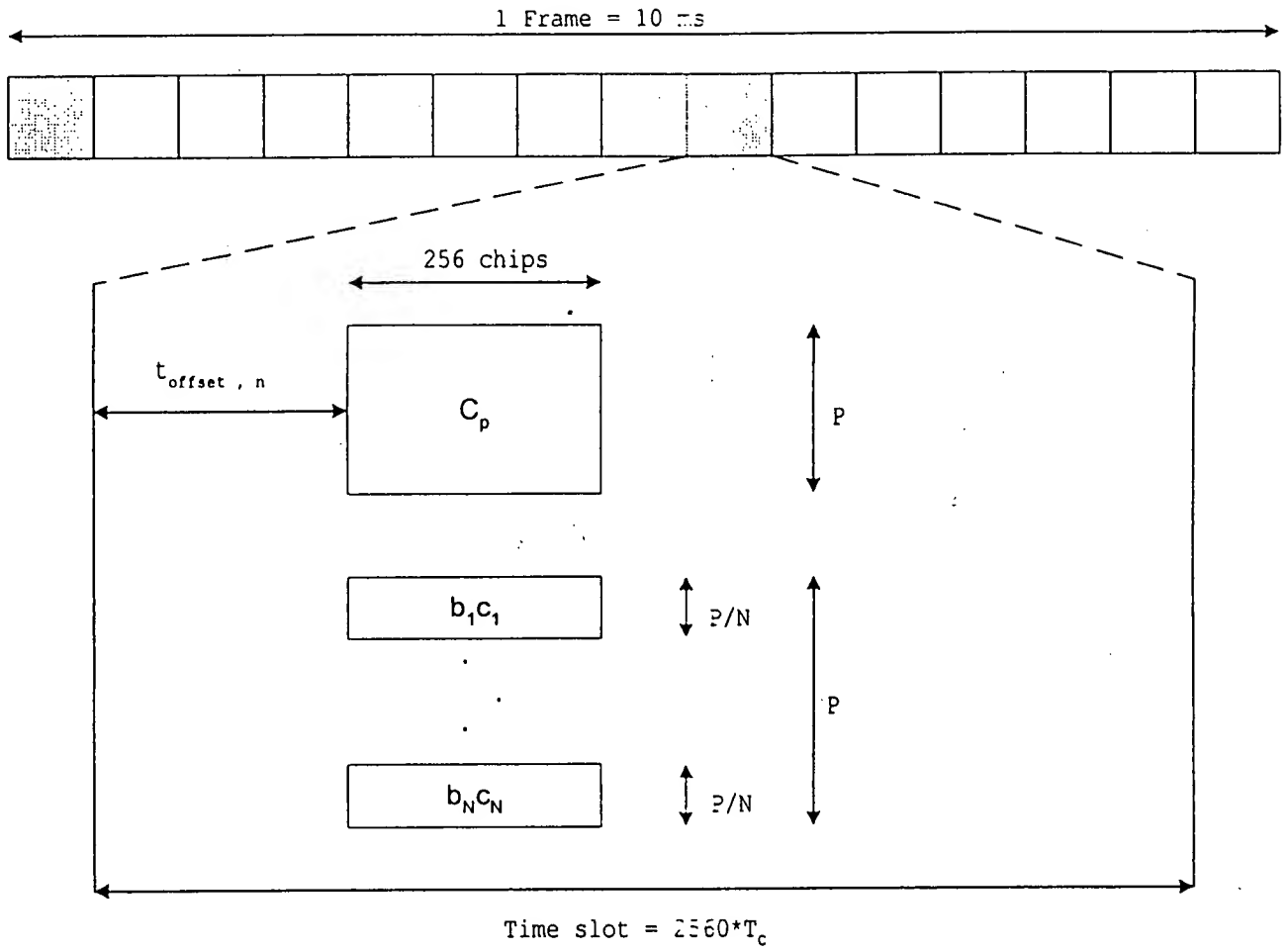


1a

Figure : Scheme for Physical Synchronisation channel PSCH consisting of one primary sequence C_p and N=3 parallel secondary sequences in slot k and k+8

Code Group	Code Set	Frame 1						Frame 2						Associated t_{offset}
		Slot k			Slot k+8			Slot k			Slot k+8			
0	1	C_0	C_1	C_2	C_0	C_1	$-C_2$	$-C_0$	$-C_1$	C_2	$-C_0$	$-C_1$	$-C_2$	t_0
1	1	C_0	$-C_1$	C_2	C_0	$-C_1$	$-C_2$	$-C_0$	C_1	C_2	$-C_0$	C_1	$-C_2$	t_1
2	1	jC_0	jC_1	C_2	jC_0	jC_1	$-C_2$	$-jC_0$	$-jC_1$	C_2	$-jC_0$	$-jC_1$	$-C_2$	t_2
3	1	jC_0	$-jC_1$	C_2	jC_0	$-jC_1$	$-C_2$	$-jC_0$	jC_1	C_2	$-jC_0$	jC_1	$-C_2$	t_3
4	1	jC_0	jC_2	C_1	jC_0	jC_2	$-C_1$	$-jC_0$	$-jC_2$	C_1	$-jC_0$	$-jC_2$	$-C_1$	t_4
5	1	jC_0	$-jC_2$	C_1	jC_0	$-jC_2$	$-C_1$	$-jC_0$	jC_2	C_1	$-jC_0$	jC_2	$-C_1$	t_5
6	1	jC_1	jC_2	C_0	jC_1	jC_2	$-C_0$	$-jC_1$	$-jC_2$	C_0	$-jC_1$	$-jC_2$	$-C_0$	t_6
7	1	jC_1	$-jC_2$	C_0	jC_1	$-jC_2$	$-C_0$	$-jC_1$	jC_2	C_0	$-jC_1$	jC_2	$-C_0$	t_7
8	2	C_3	C_4	C_5	C_3	C_4	$-C_5$	$-C_3$	$-C_4$	C_5	$-C_3$	$-C_4$	$-C_5$	t_8
9	2	C_3	$-C_4$	C_5	C_3	$-C_4$	$-C_5$	$-C_3$	C_4	C_5	$-C_3$	C_4	$-C_5$	t_9
10	2	jC_3	jC_4	C_5	jC_3	jC_4	$-C_5$	$-jC_3$	$-jC_4$	C_5	$-jC_3$	$-jC_4$	$-C_5$	t_{10}
11	2	jC_3	$-jC_4$	C_5	jC_3	$-jC_4$	$-C_5$	$-jC_3$	jC_4	C_5	$-jC_3$	jC_4	$-C_5$	t_{11}
12	2	jC_3	jC_5	C_4	jC_3	jC_5	$-C_4$	$-jC_3$	$-jC_5$	C_4	$-jC_3$	$-jC_5$	$-C_4$	t_{12}
13	2	jC_3	$-jC_5$	C_4	jC_3	$-jC_5$	$-C_4$	$-jC_3$	jC_5	C_4	$-jC_3$	jC_5	$-C_4$	t_{13}
14	2	jC_4	jC_5	C_3	jC_4	jC_5	$-C_3$	$-jC_4$	$-jC_5$	C_3	$-jC_4$	$-jC_5$	$-C_3$	t_{14}
15	2	jC_4	$-jC_5$	C_3	jC_4	$-jC_5$	$-C_3$	$-jC_4$	jC_5	C_3	$-jC_4$	jC_5	$-C_3$	t_{15}
16	3	C_6	C_7	C_8	C_6	C_7	$-C_8$	$-C_6$	$-C_7$	C_8	$-C_6$	$-C_7$	$-C_8$	t_{16}
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	3	jC_7	$-jC_8$	C_6	jC_7	$-jC_8$	$-C_6$	$-jC_7$	jC_8	C_6	$-jC_7$	jC_8	$-C_6$	t_{20}
24	4	C_9	C_{10}	C_{11}	C_9	C_{10}	$-C_{11}$	$-C_9$	$-C_{10}$	C_{11}	$-C_9$	$-C_{10}$	$-C_{11}$	t_{24}
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	4	jC_{10}	$-jC_{11}$	C_9	jC_{10}	$-jC_{11}$	$-C_9$	$-jC_{10}$	jC_{11}	C_9	$-jC_{10}$	jC_{11}	$-C_9$	t_{31}

NOTE: The code construction for code groups 0 to 15 using the SCH codes from code sets 1 and 2 is shown. The construction for code groups 16 to 31 using the SCH codes from code sets 3 and 4 is done in the same way.

Fig. 1b

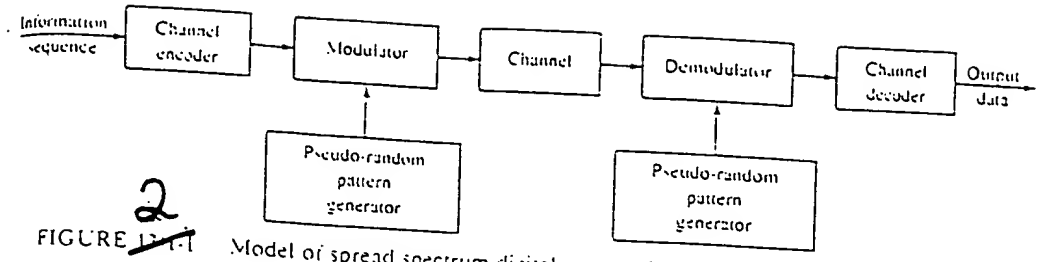


FIGURE 2 Model of spread spectrum digital communication system.

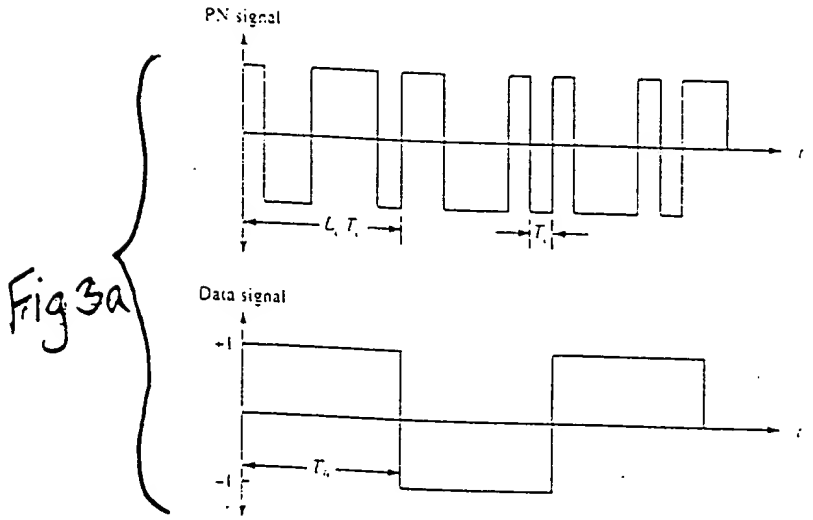
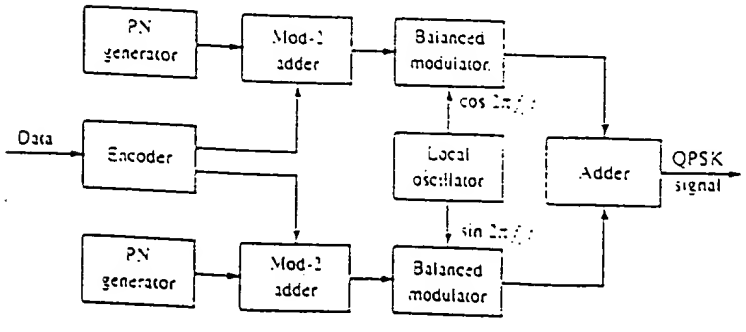


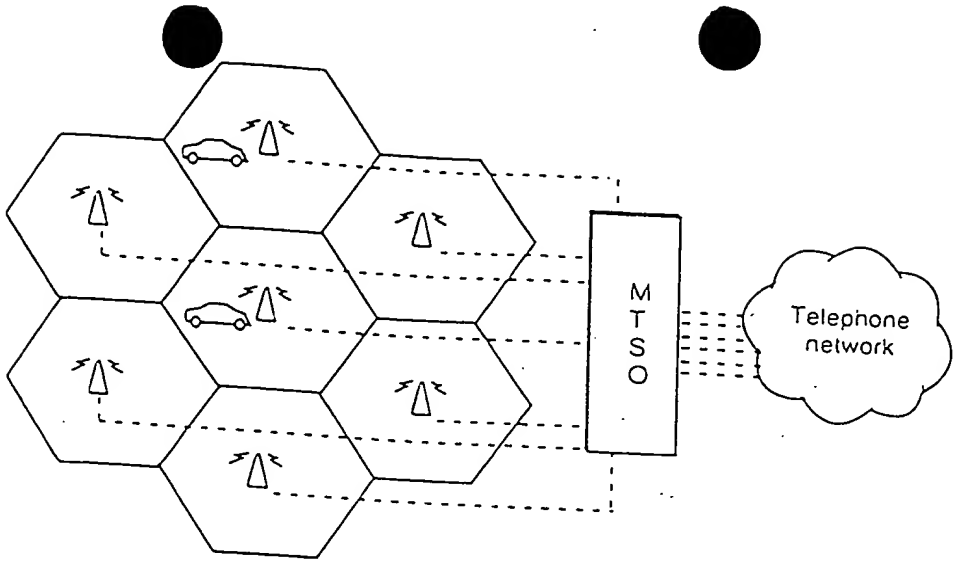
Fig 3a

(a) PN and data signals



3b

FIGURE ~~3.1~~ ~~(b) QPSK modulator~~ The PN and data signals (a) and the QPSK modulator (b) for a DS spread spectrum system.



= Base transceiver station (BTS)

MTSO = Mobile telephone switching office

= Mobile unit (mobile station)

- - - - = Dedicated lines

Figure 4
Cellular radio topology.

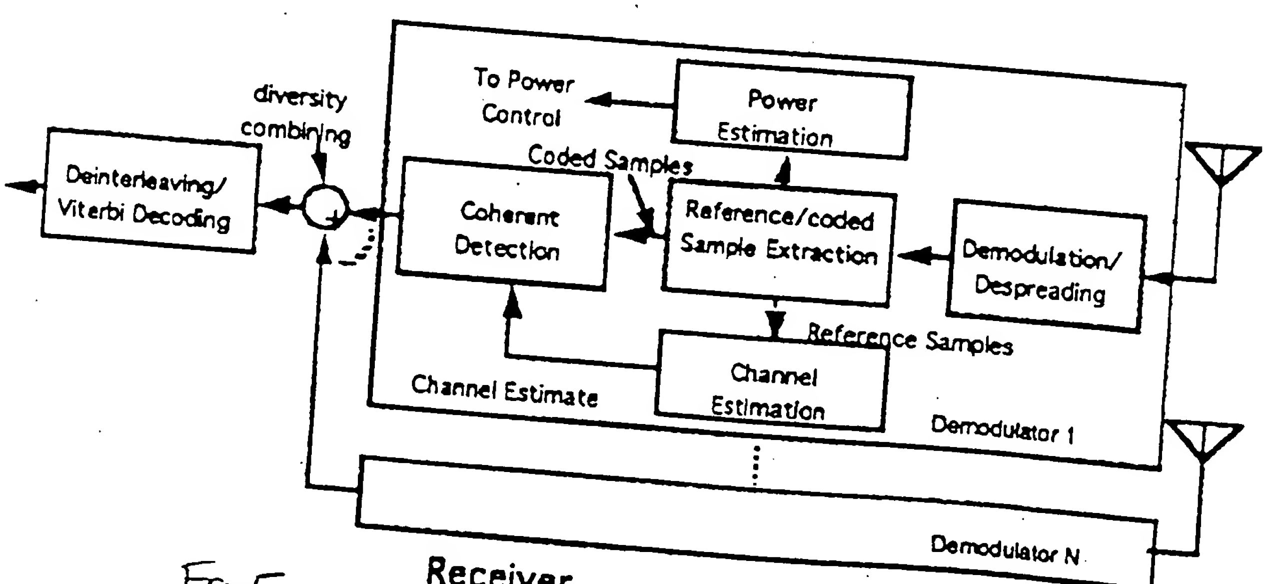


Fig 5 Receiver

NOTE: Modulation by "j" indicates that the code is transmitted on the Q channel.

Table 4: Code Allocation for Case 1

Code Group	Code Set	Frame 1			Frame 2			Associated t_{offset}
0	1	C_0	C_1	C_2	C_0	C_1	$-C_2$	t_0
1	1	C_0	$-C_1$	C_2	C_0	$-C_1$	$-C_2$	t_1
2	1	$-C_0$	C_1	C_2	$-C_0$	C_1	$-C_2$	t_2
3	1	$-C_0$	$-C_1$	C_2	$-C_0$	$-C_1$	$-C_2$	t_3
4	1	jC_0	JC_1	C_2	jC_0	jC_1	$-C_2$	t_4
5	1	jC_0	$-jC_1$	C_2	jC_0	$-jC_1$	$-C_2$	t_5
6	1	$-jC_0$	JC_1	C_2	$-jC_0$	jC_1	$-C_2$	t_6
7	1	$-jC_0$	$-jC_1$	C_2	$-jC_0$	$-jC_1$	$-C_2$	t_7
8	1	jC_0	JC_2	C_1	jC_0	jC_2	$-C_1$	t_8
9	1	jC_0	$-jC_2$	C_1	jC_0	$-jC_2$	$-C_1$	t_9
10	1	$-jC_0$	JC_2	C_1	$-jC_0$	jC_2	$-C_1$	t_{10}
11	1	$-jC_0$	$-jC_2$	C_1	$-jC_0$	$-jC_2$	$-C_1$	t_{11}
12	1	jC_1	JC_2	C_0	JC_1	jC_2	$-C_0$	t_{12}
13	1	jC_1	$-jC_2$	C_0	JC_1	$-jC_2$	$-C_0$	t_{13}
14	1	$-jC_1$	JC_2	C_0	$-jC_1$	jC_2	$-C_0$	t_{14}
15	1	$-jC_1$	$-jC_2$	C_0	$-jC_1$	$-jC_2$	$-C_0$	t_{15}
16	2	C_3	C_4	C_5	C_3	C_4	$-C_5$	t_{16}
17	2	C_3	$-C_4$	C_5	C_3	$-C_4$	$-C_5$	t_{17}
...	...	...	...	...	...	...	...	...
20	2	jC_3	JC_4	C_5	jC_3	jC_4	$-C_5$	t_{20}
...	...	...	...	...	...	...	...	...
24	2	jC_3	jC_5	C_4	jC_3	JC_5	$-C_4$	t_{24}
...	...	...	...	...	...	...	...	...
31	2	$-jC_4$	$-jC_5$	C_3	$-jC_4$	$-jC_5$	$-C_3$	t_{31}

NOTE: The code construction for code groups 0 to 15 using only the SCH codes from code set 1 is shown. The construction for code groups 16 to 31 using the SCH codes from code set 2 is done in the same way.

Fig. 6

In addition to the information on code group three bits from SCH transport channel are transmitted to the UE with these codes.

Code Group	Code Set	Frame 1						Frame 2						Associated t_{offset}	Addl bits from SCH transport channel
		Slot k			Slot k+8			Slot k			Slot k+8				
0	1	C_0	C_1	C_2	C_0	C_1	$-C_2$	$-C_0$	$-C_1$	C_2	$-C_0$	$-C_1$	$-C_2$	t_0	000
1	1	C_0	$-C_1$	C_2	C_0	$-C_1$	$-C_2$	$-C_0$	C_1	C_2	$-C_0$	C_1	$-C_2$	t_1	000
2	1	jC_0	jC_1	C_2	jC_0	jC_1	$-C_2$	$-jC_0$	$-jC_1$	C_2	$-jC_0$	$-jC_1$	$-C_2$	t_2	000
3	1	jC_0	$-jC_1$	C_2	jC_0	$-jC_1$	$-C_2$	$-jC_0$	jC_1	C_2	$-jC_0$	jC_1	$-C_2$	t_3	000
4	1	jC_0	jC_2	C_1	jC_0	jC_2	$-C_1$	$-jC_0$	$-jC_2$	C_1	$-jC_0$	$-jC_2$	$-C_1$	t_4	000
5	1	jC_0	$-jC_2$	C_1	jC_0	$-jC_2$	$-C_1$	$-jC_0$	jC_2	C_1	$-jC_0$	jC_2	$-C_1$	t_5	000
6	1	jC_1	jC_2	C_0	jC_1	jC_2	$-C_0$	$-jC_1$	$-jC_2$	C_0	$-jC_1$	$-jC_2$	$-C_0$	t_6	000
7	1	jC_1	$-jC_2$	C_0	jC_1	$-jC_2$	$-C_0$	$-jC_1$	jC_2	C_0	$-jC_1$	jC_2	$-C_0$	t_7	000
8	2	C_3	C_4	C_5	C_3	C_4	$-C_5$	$-C_3$	$-C_4$	C_5	$-C_3$	$-C_4$	$-C_5$	t_8	000
9	2	C_3	$-C_4$	C_5	C_3	$-C_4$	$-C_5$	$-C_3$	C_4	C_5	$-C_3$	C_4	$-C_5$	t_9	000
10	2	jC_3	jC_4	C_5	jC_3	jC_4	$-C_5$	$-jC_3$	$-jC_4$	C_5	$-jC_3$	$-jC_4$	$-C_5$	t_{10}	000
11	2	jC_3	$-jC_4$	C_5	jC_3	$-jC_4$	$-C_5$	$-jC_3$	jC_4	C_5	$-jC_3$	jC_4	$-C_5$	t_{11}	000
12	2	jC_3	jC_5	C_4	jC_3	jC_5	$-C_4$	$-jC_3$	$-jC_5$	C_4	$-jC_3$	$-jC_5$	$-C_4$	t_{12}	000
13	2	jC_3	$-jC_5$	C_4	jC_3	$-jC_5$	$-C_4$	$-jC_3$	jC_5	C_4	$-jC_3$	jC_5	$-C_4$	t_{13}	000
14	2	jC_4	jC_5	C_3	jC_4	jC_5	$-C_3$	$-jC_4$	$-jC_5$	C_3	$-jC_4$	$-jC_5$	$-C_3$	t_{14}	000
15	2	jC_4	$-jC_5$	C_3	jC_4	$-jC_5$	$-C_3$	$-jC_4$	jC_5	C_3	$-jC_4$	jC_5	$-C_3$	t_{15}	000
16	3	C_6	C_7	C_8	C_6	C_7	$-C_8$	$-C_6$	$-C_7$	C_8	$-C_6$	$-C_7$	$-C_8$	t_{16}	000
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	4	jC_{10}	$-jC_{11}$	C_9	jC_{10}	$-jC_{11}$	$-C_9$	$-jC_{10}$	jC_{11}	C_9	$-jC_{10}$	jC_{11}	$-C_9$	t_{31}	000
0	5	C_{12}	C_{13}	C_{14}	C_{12}	C_{13}	$-C_{14}$	$-C_{12}$	$-C_{13}$	C_{14}	$-C_{12}$	$-C_{13}$	$-C_{14}$	t_0	001
1	5	C_{12}	$-C_{13}$	C_{14}	C_{12}	$-C_{13}$	$-C_{14}$	$-C_{12}$	C_{13}	C_{14}	$-C_{12}$	C_{13}	$-C_{14}$	t_1	001
2	5	jC_{12}	jC_{13}	C_{14}	jC_{12}	jC_{13}	$-C_{14}$	$-jC_{12}$	$-jC_{13}$	C_{14}	$-jC_{12}$	$-jC_{13}$	$-C_{14}$	t_2	001
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	8	jC_5	$-jC_8$	C_0	jC_5	$-jC_8$	$-C_0$	$-jC_5$	jC_8	C_0	$-jC_5$	jC_8	$-C_0$	t_{31}	001
0	9	C_0	C_9	C_{12}	C_0	C_9	$-C_{12}$	$-C_0$	$-C_9$	C_{12}	$-C_0$	$-C_9$	$-C_{12}$	t_0	010
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	32	jC_9	jC_{15}	C_7	jC_9	jC_{15}	$-C_7$	$-jC_9$	$-jC_{15}$	C_7	$-jC_9$	$-jC_{15}$	$-C_7$	t_{30}	111
31	32	jC_9	$-jC_{15}$	C_7	jC_9	$-jC_{15}$	$-C_7$	$-jC_9$	jC_{15}	C_7	$-jC_9$	jC_{15}	$-C_7$	t_{31}	111

8 × 32 = 256 code groups

NOTE: The code construction using code sets 1 to 4 is exactly the same as for Case 2, and the additional bits from the SCH transport channel are "000". The code construction from code sets 5 to 32 is done in the same way with the additional bits for code sets 5 to 8 being "001", code sets 9 to 12 being "010", code sets 13 to 16 being "011", code sets 17 to 20 being "100", code sets 21 to 24 being "101", code sets 25 to 28 being "110", and code sets 29 to 32 being "111".

Fig. 7a

Code set 1: C_0, C_1, C_2.

Code set 2: C_3, C_4, C_5.

Code set 3: C_6, C_7, C_8.

Code set 4: C_9, C_{10}, C_{11}.

Code set 5: C_{12}, C_{13}, C_{14}.

Code set 6: C_0, C_3, C_6.

Code set 7: C_0, C_4, C_7

Code set 8: C_0, C_5, C_8.

Code set 9: C_0, C_9, C_{12}.

Code set 10: C_0, C_{10}, C_{13}.

Code set 11: C_0, C_{11}, C_{14}.

Code set 12: C_1, C_3, C_7.

Code set 13: C_1, C_4, C_6.

Code set 14: C_1, C_5, C_9.

Code set 15: C_1, C_8, C_{10}.

Code set 16: C_1, C_{11}, C_{12}.

Code set 17: C_1, C_{13}, C_{15}.

Code set 18: C_2, C_3, C_8.

Code set 19: C_2, C_4, C_9.

Code set 20: C_2, C_5, C_6.

Code set 21: C_2, C_7, C_{10}.

Code set 22: C_2, C_{11}, C_{13}.

Code set 23: C_2, C_{12}, C_{15}

Code set 24: C_3, C_9, C_{13}.

Code set 25: C_3, C_{10}, C_{12}.

Code set 26: C_3, C_{11}, C_{15}.

Code set 27: C_4, C_8, C_{11}.

Code set 28: C_4, C_{10}, C_{14}.

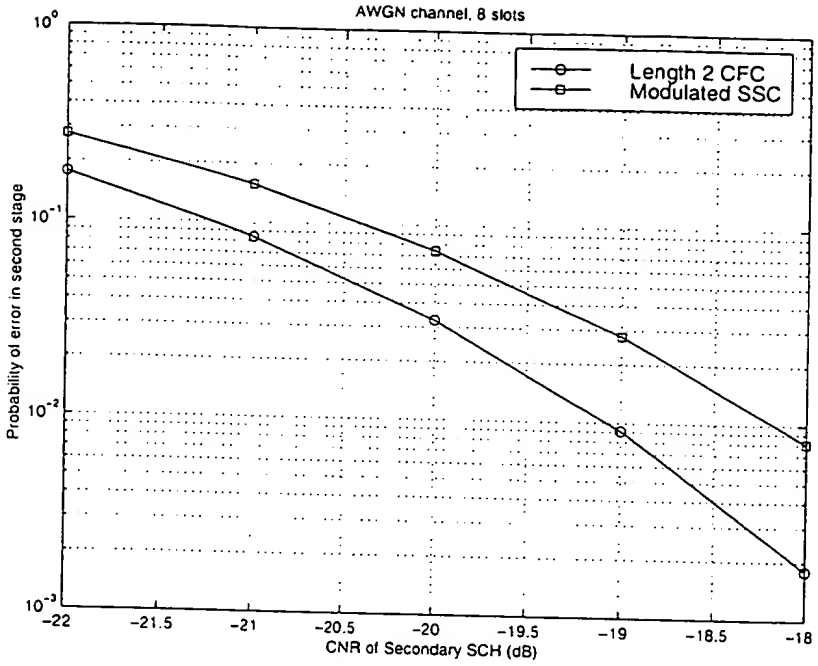
Code set 29: C_5, C_7, C_{11}.

Code set 30: C_5, C_{10}, C_{15}.

Code set 31: C_6, C_9, C_{14}.

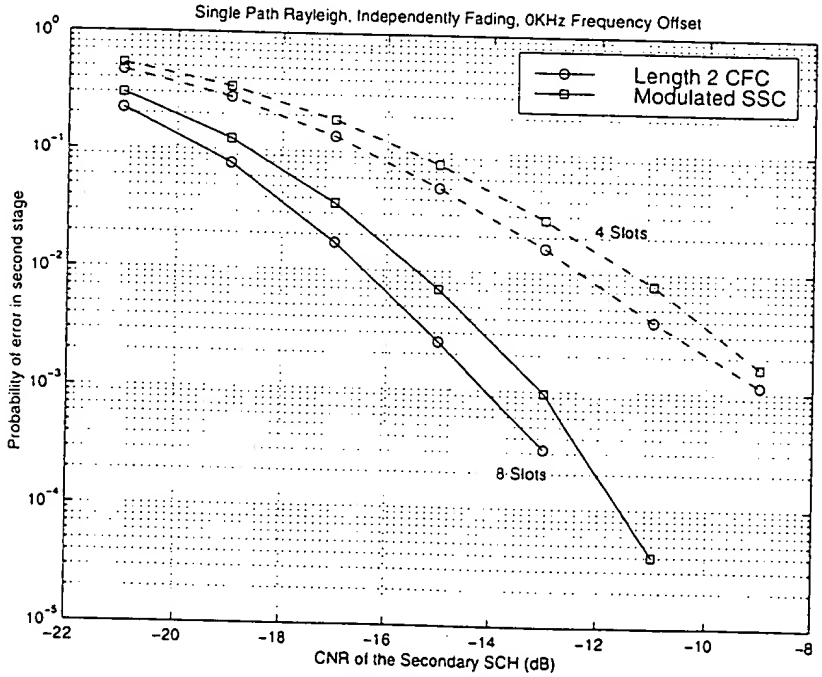
Code set 32: C_7, C_9, C_{15}.

Fig. 7b



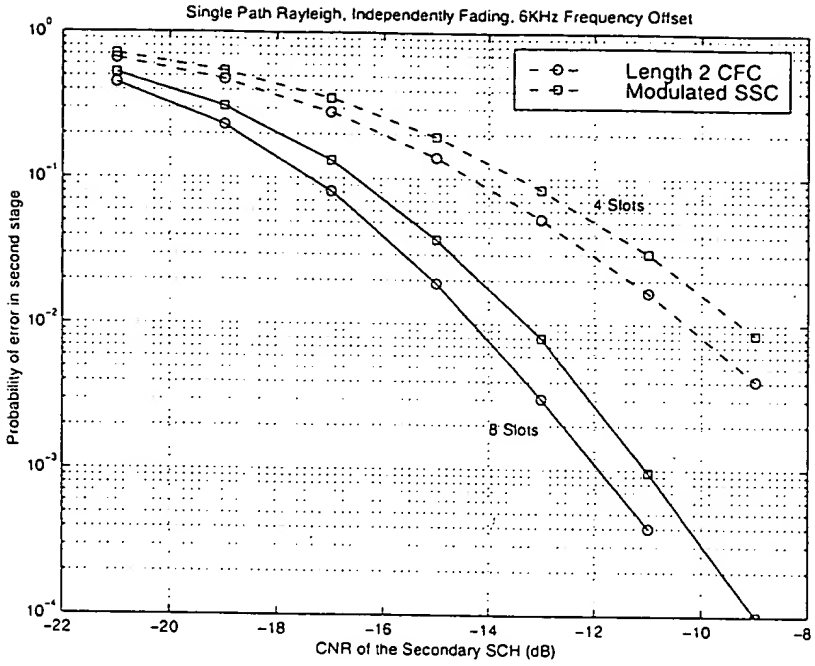
8

Figure 7. Figure comparing the Stage 2 performance of the Length 2 CFC to that of the Modulated SSC method for the AWGN case. The figure shows that the proposed method performs about 1.0dB better than the Modulated SSC method. 8 slots were used in Stage 2.



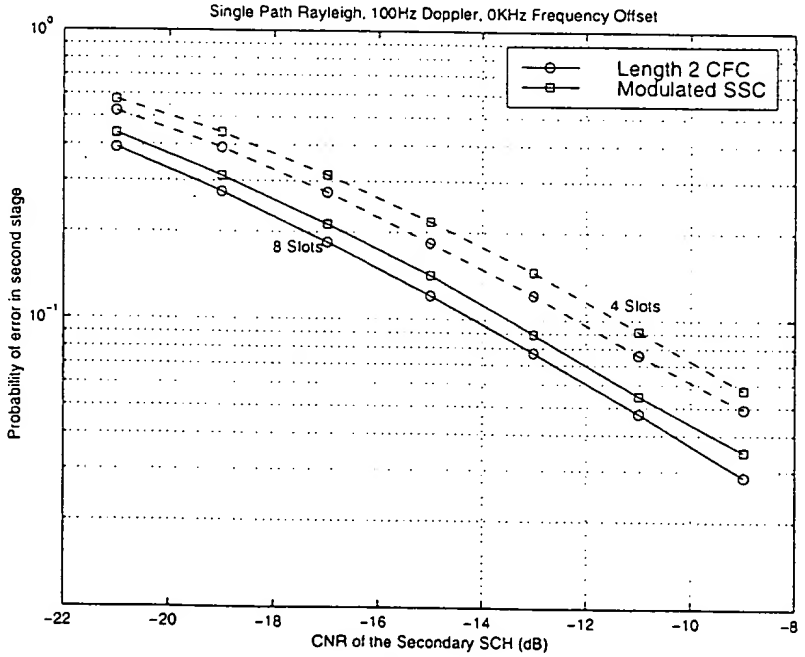
9

Figure 8. Figure comparing the Stage 2 performance of the length 2 CFC with that of the Modulated SSC scheme for the Rayleigh fading case. The figure shows that the performance of the length 2 CFC is better than that of the modulated SSC method by about 1.0dB for both 4 and 8 slots case. This is because the length 2 CFC has better distance than the modulated SSC method.



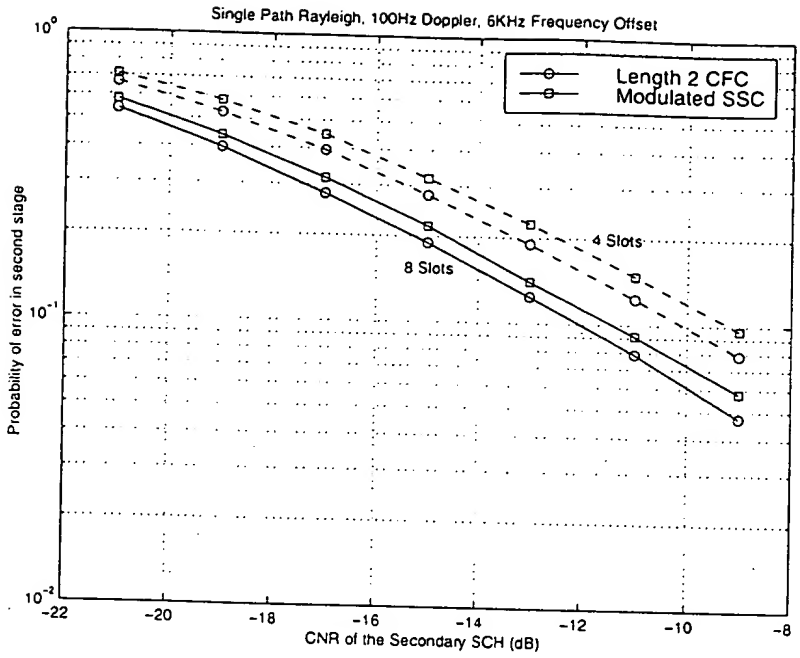
10

Figure 3. Figure comparing the Stage 2 performance of the length 2 CFC with that of the Modulated SSC scheme for the Rayleigh fading case under a 6KHz Frequency error. The figure shows that the performance of the length 2 CFC is still better than that of the modulated SSC method by about 1.0dB for both 4 and 8 slots case.



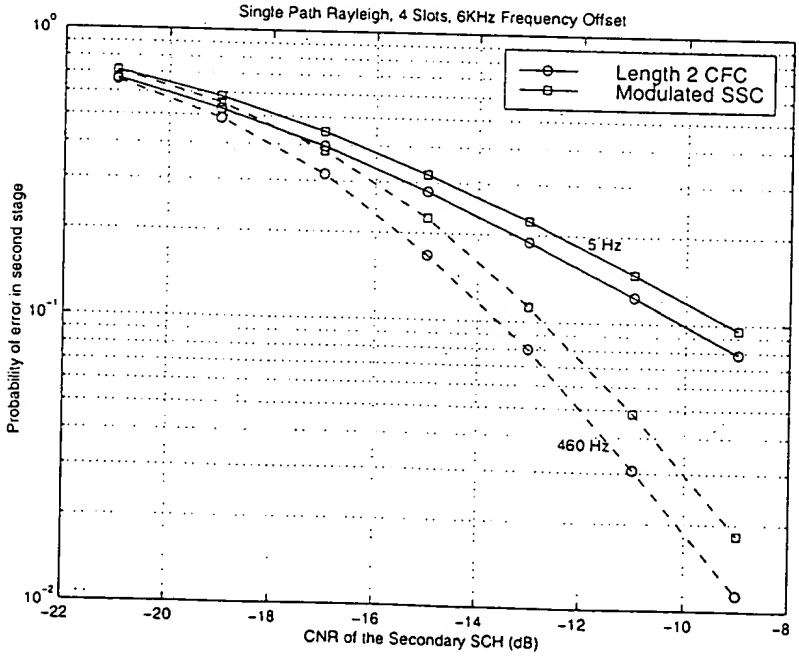
11

Figure 4. Figure comparing the Stage 2 performance of the length 2 CFC with that of the Modulated SSC scheme for the single path Rayleigh fading case, with a Doppler of 100Hz. There is no Frequency error. The figure shows that the performance of the length 2 CFC is still better than that of the modulated SSC method by about 1.0dB for both 4 and 8 slots case.



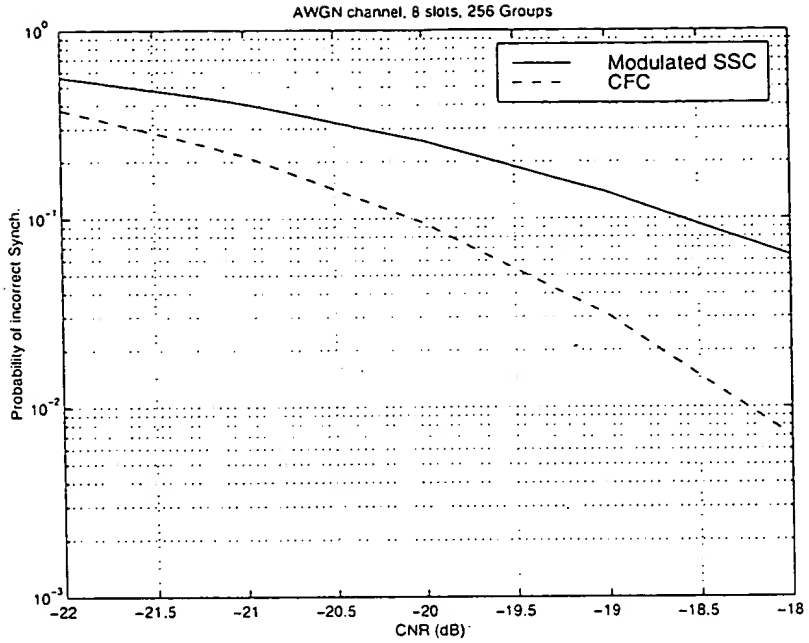
12

Figure 5. Figure comparing the Stage 2 performance of the length 2 CFC with that of the Modulated SSC scheme for the single path Rayleigh fading case, with a Doppler of 100Hz. The Frequency error is 6KHz. The figure shows that the performance of the length 2 CFC is still better than that of the modulated SSC method by about 1.0dB for both 4 and 8 slots case.



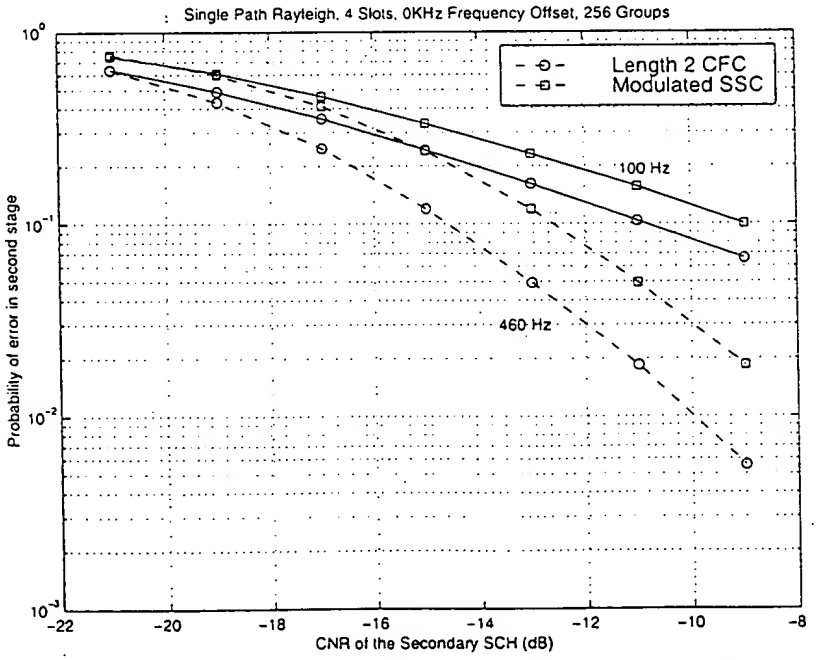
13

Figure 6. Figure comparing the Stage 2 performance of the length 2 CFC with that of the Modulated SSC scheme for the single path Rayleigh fading case, with Doppler's of 5Hz and 460Hz. The Frequency error is 6KHz and the number of slots was 4. The figure shows that the performance of the length 2 CFC is still better than that of the modulated SSC method by about



14

Figure 7. Figure comparing the Stage 2 performance of the length 2 CFC with that of the Modulated SSC scheme for the AWGN case. The number of long code groups is 256. The figure shows that the performance of the length 2 CFC is better than that of the modulated SSC method is greater than 1.5dB.



15

Figure 8. Figure comparing the Stage 2 performance of the length 2 CFC with that of the Modulated SSC scheme for the single path Rayleigh fading case, with Doppler's of 100Hz and 460Hz. There is no Frequency error and the number of slots was 4. The figure shows that the performance of the length 2 CFC is still better than that of the modulated SSC method by about 2.0dB.